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# स्वचल वाहन – दुपहिया या तिपहिया वाहनों की ईंधन टंकियाँ

# *Indian Standard*
# AUTOMOTIVE VEHICLES – FUEL TANKS FOR TWO OR THREE WHEELERS

ICS 43.140;43.040.60

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**BUREAU OF INDIAN STANDARDS**
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NEW DELHI 110002

*June* 1999

**Price Group 3**

Automotive Body and Chassis Sectional Committee, TED 6

## FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Automotive Body and Chassis Sectional Committee had been approved by the Transport Engineering Division Council.

In preparation of this standard considerable assistance has been derived from 97/24/EEC 'Technical requirement relating to fuel tanks for two or three-wheeled vehicles'.

The committee responsible for preparation of this standard is given in Annex B.

## *Indian Standard*

# AUTOMOTIVE VEHICLES — FUEL TANKS FOR TWO OR THREE WHEELERS

## 1 SCOPE

This standard specifies requirements of fuel tanks for two or three-wheeled vehicles.

## 2 GENERAL REQUIREMENTS

**2.1** Fuel tank shall be made of materials, the thermal, mechanical and chemical behaviour of which shall be suitable for its intended conditions of use.

**2.2** Fuel tanks and attachment systems shall be so designed, manufactured and installed as to fulfil their function in all driving conditions.

**2.3** Fuel tanks and the adjacent parts shall be so designed as not to generate any electrostatic charge which is likely to cause sparking between the tank and the chassis of the vehicle which is likely to ignite the fuel/air mixture.

**2.4** Engine fuel system components shall be suitably located so as not to get affected by any obstacles from the ground in all driving conditions.

The fuel filling system shall be designed, manufactured and installed in such a way as to withstand the effects of any internal and external corrosion to which it is exposed. No motion due to torsion, flexing and vibration of the vehicle structure, engine and transmission shall subject fuel-system components to abnormal friction or stressing.

**2.5** Fuel tanks shall be made in such a way as to withstand corrosion.

**2.6** Any excess pressure or any pressure exceeding the service pressure shall be automatically released by appropriate devices (orifices, safety valves, etc) the ventilation orifices shall be designed in such a way as to preclude any risk of ignition.

## 3 TESTS

**3.1** Fuel tanks shall pass the leak tightness test at a pressure that is at least equal to a pressure of 30 kPa (gauge).

**3.2** The fuel shall be unable to flow from the filler cap or any devices fitted in order to release excess pressure even if the tank filled up to 90 percent of its capacity is fully inverted, dripping shall not be more than 40 ml per minute at the end of 5 minutes.

## 4 ADDITIONAL TEST FOR NON-METALLIC FUEL TANK

### 4.1 Permeability Test

**4.1.1** *Test Method*

The fuel tank shall be tested at a temperature of 40 ± 2°C. The test fuel to be used shall be the reference fuel used during emission test on two or three-wheeled motor vehicles.

Prior to test, the tank shall be filled up to 50 percent of its rated capacity with test fuel and kept in the temperature condition of 40 ± 2°C at least for 4 weeks or until there is a constant weight loss (pre-storage period).

The tank shall be emptied and then refilled to 50 percent of its rated capacity with test fuel after which it shall be closed and then stored under the stabilizing conditions at a temperature of 40 ± 2°C under the test pressure of 30 kPa (gauge). The pressure rise in the tank during the test may be compensated.

The weight loss due to diffusion shall be determined during the eight-week test. During that test a maximum quantity of 20 g may escape, on average, every 24 hours. If the diffusion losses are greater, the fuel loss must also be determined at an ambient temperature of 23 ± 2°C, all other conditions being maintained (pre-storage of 40 ± 2°C). The loss determined under those conditions shall not exceed 10 g per 24 hours.

When the test is conducted with internal pressure compensation, which must be mentioned in the test report, the fuel loss resulting from the pressure compensation must be taken into account when the diffusion loss is established.

### 4.2 Shock Test

**4.2.1** This test shall be applicable only if the fuel tank is fully exposed.

#### 4.2.2 *Test Method*

The fuel tank shall be filled up to its nominal capacity with a mixture of 50 percent water and ethylene glycol or with any other coolant which does not attack the fuel tank material, the freezing point of which is lower than –30 ± 2°C.

The temperature of the substances contained in the fuel tank during the test shall be –20 ± 2°C. The fuel tank shall be filled with a suitably refrigerated liquid provided after ensuring that the fuel tank is left at the test temperature for at least one hour.

A pendulum shall be used for the test, its impact head shall take the form of an equilateral triangular pyramid having a radius of curvature of 3 mm at its peaks and tips with a mass of 15 kg the pendulum's energy may not be less than 30 J, and as close as possible to that value.

It is recommended that while designing the pendulum following aspects may be considered:

i) The centre of percussion of pendulum shall be as close as possible to centre of gravity of pyramid,

ii) The distance of centre of gravity of pyramid to its axis of rotation shall be 1 m,

iii) Total mass of the pendulum referred to its centre of percussion shall be 15 kg, and

iv) The tank shall be mounted on a fixture as it is mounted on the vehicle.

The points on the fuel tank to be tested shall be those considered at risk as a result of the fitting of the tank and its position on the vehicle. There must be no liquid leakage following a single impact at any of those points.

### 4.3 Mechanical Strength

#### 4.3.1 *Test Method*

The fuel tank shall be filled up to its rated capacity, the test liquid used being water at 53 ± 2°C. The relative internal pressure shall be 30 ± 5 kPa (gauge).

The tank shall remain closed for a period of 5 hours.

No deformation which may arise may render the fuel tank unusable (for example, the tank must not be perforated). Even after this deformation, there should not be any problem in fitting the tank on vehicle.

### 4.4 Fuel-Resistance Test

#### 4.4.1 *Test Method*

Six tensile-test pieces of approximately the same thickness shall be taken from the flat pieces. Their tensile strength and elastic limits shall be established at 23 ± 2°C at an elongation rate of 50 mm/min. These values shall be compared with the tensile strength and elasticity values obtained by similar tests using a fuel tank that has already been stored for the pre-storage period. The material shall be considered to be acceptable if there has been no difference in tensile strength of more than 25 percent.

### 4.5 Fire-Resistance Test

#### 4.5.1 *Test Method*

The tank material shall not burn at a flame speed greater than 0.64 mm/s when tested as per Annex A.

### 4.6 High Temperature Test

#### 4.6.1 *Test Method*

The fuel tank, filled to 50 percent of its rated capacity with water at ambient temperature shall not display plastic deformation or leak after storage for one hour at a temperature of 70 ± 2°C.

No deformation may arise to make the tank unusable. Even after this deformation, there should not be any problem in fitting the tank on vehicle.

The testing device shall take account of the fitting conditions.

## 5 GUIDELINES FOR DECIDING TESTS FOR EXTENSION OF TYPE APPROVAL

**5.1** The type approval granted to any vehicle model in accordance with this standard, shall be extended to its variants/new models in following cases:

a) In variant/new model, the material, the mounting arrangement, size and shape of fuel tank is same as type approved.

b) In variant/new model, the arrangement of fuel filling system is same as that of vehicle model already type approved.

**5.2** The extension of type approval to variants/new models as mentioned in **5.1**, shall be granted irrespective of change in the model name.

**5.3** If the type approval already granted to a vehicle model can not be extended to variant/new model due to design change mentioned in **5.1**(a) and **5.1**(b), only the checks/tests relevant to that design change shall be carried out and extension shall be granted if these checks/tests are satisfactory.

Following guidelines may be followed:

| *Design Change* | *Checks/Tests to be Conducted* |
|---|---|
| i) Material of fuel tank in case of plastic | All tests as per **4**, as applicable |
| ii) Mounting arrangement of fuel tank | Shock test as per **4.2**, if applicable |
| iii) Arrangement of fuel filling system | Check as per **3.1** and **3.2** |
| iv) Fuel tank of a model type approved is relocated or used at a relocated position in other variants/new model | If tank is made of non-metallic material tests as per **4.1** to **4.6** as applicable. If tank is made of metal no tests are required |
| v) Design change size and shape of fuel tank | Tests as per **3.1**, **4.2** and **4.3** to be repeated |

# ANNEX A

## (*Clause* 4.5.1)

## FIRE RESISTANCE TEST METHOD

### A-1 TEST EQUIPMENT

### A-1.1 Test Chamber

A totally enclosed laboratory fume test chamber with a heat resistant test-observation window.

A mirror may be used in certain test enclosures in order to provide a rear view of the sample.

The fume extractor fan shall be shut down during the test and restarted immediately after the test in order to remove any toxic combustion products.

Alternatively the test may be carried out inside a metal box placed beneath the fume test chamber with the extractor fan operating.

The top and bottom walls of the box shall incorporate ventilation holes enabling sufficient air for the combustion to pass through while not subjecting the burning sample to a drought.

### A-1.2 Supporting Base

A laboratory supporting base including two grips which can be set in any position by means of swivel joints (*see* Fig. 1).

### A-1.3 Burner

A gas-fired Bunsen (or Tirril) type with a 10-mm nozzle such that flame can come in direct contact with test piece.

### A-1.4 Metal Mesh

Mesh size 20.

### A-1.5 Timer

A timer or similar device with divisions not greater than one second.

### A-1.6 Water Bath

### A-1.7 Graduated Scale

Graduation in millimetres placed suitably.

### A-2 TEST SAMPLE

**A-2.1** At least 10 test samples 125 ± 5 mm long × 12.5 ± 0.2 mm wide must be taken direct from a typical fuel tank.

If otherwise prevented by the shape of the fuel tank part of the tank shall be moulded into a plate that is 3 mm thick and sufficient in area to enable the necessary samples to be taken.

**A-2.2** The samples must normally be tested in their type-approval state unless otherwise specified.

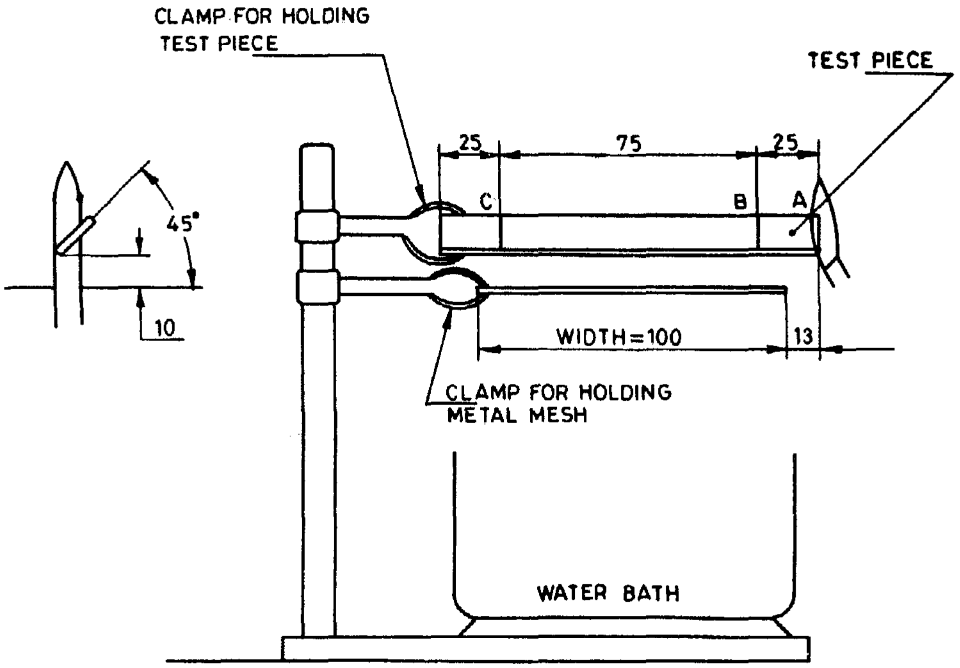
**A-2.3** Two lines, one at 25 mm and the other at 100 m from one end shall be marked on each sample.

**A-2.4** The edges of the test samples shall be smooth.

### A-3 TEST METHOD

**A-3.1** The sample shall be attached to one of the grips on the base by the end closest to the 100-mm mark, its longitudinal axis being horizontal and its transverse axis at 45° to the horizontal. A woven metal screen shall be attached beneath the test sample, to be located 10 mm horizontally below the edge of the sample and the distance between edges of samples and mesh end should be approximately 13 mm (*see* Fig. 1). Before each test any residue remaining on the metal screen shall be burnt or the screen replaced.

A bath full of water shall be placed on the fume hood table in such a way as to receive any incandescent particles which may fall during the test.



All dimensions in millimetres.

FIG. 1 TEST APPARATUS FOR FIRE RESISTANCE TEST

**A-3.2** The air supply to the burner shall be set in such a way as to obtain a blue flame roughly 25 mm high.

**A-3.3** The burner shall be placed such that its flame touches the outer edge of the test sample as shown in Fig. 1 and at the same time the timer shall be started.

**A-3.4** The burner flame shall be used in contact with sample for 30 seconds. If the sample captures the flame and the flame starts propagating by itself, the burner shall be moved away by atleast 4 mm from the edge of the sample.

If the sample deforms, melts or shrinks without capturing the flame, the burner shall be moved along the sample maintaining the contact till 25 mm from the edge (till mark *B*). If the flame is not captured even in this condition, the tank shall be deemed to have passed the test :

i) If the sample has captured the flame, note the time required for the flame to reach 100-mm mark from 25-mm mark (that is from line *B* towards *C*). This shall be noted as time '*t*' (in seconds).

   The rate of flame speed shall be calculated as 75/*t* (mm/s).

   Total of 3 samples shall be tested and if the flame reaches 100-mm mark in each case average of the 3 '*t*'s shall be taken and flame speed shall be calculated. Flame speed shall not be more 0.64 mm/s (**4.5.1**).

ii) In case of testing 10 new samples, find out average combustion time and average combustion length from 25 mm mark towards 100 mm mark (from mark '*B*' towards mark '*C*'). The rate of flame speed shall be calculated by dividing average combustion length by average combustion time which should not be more than 0.64 mm/s (*see* **4.5.1**).

**A-3.5** The complete result shall include the following information.

**A-3.5.1** Identification of the sample, including the method of preparation and storage.

**A-3.5.2** Average sample thickness to be ±1 percent.

**A-3.5.3** Number of samples tested.

**A-3.5.4** Dispersion of combustion time values.

**A-3.5.5** Dispersion of the combustion length values.

**A-3.5.6** If a sample does not burn up to the mark because it drips, runs or breaks up into burnt particles this must be stated.

**A-3.5.7** If a sample is re-ignited by burning material deposited on the woven metal screen that must be stated.

# ANNEX B
*( Foreword)*

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